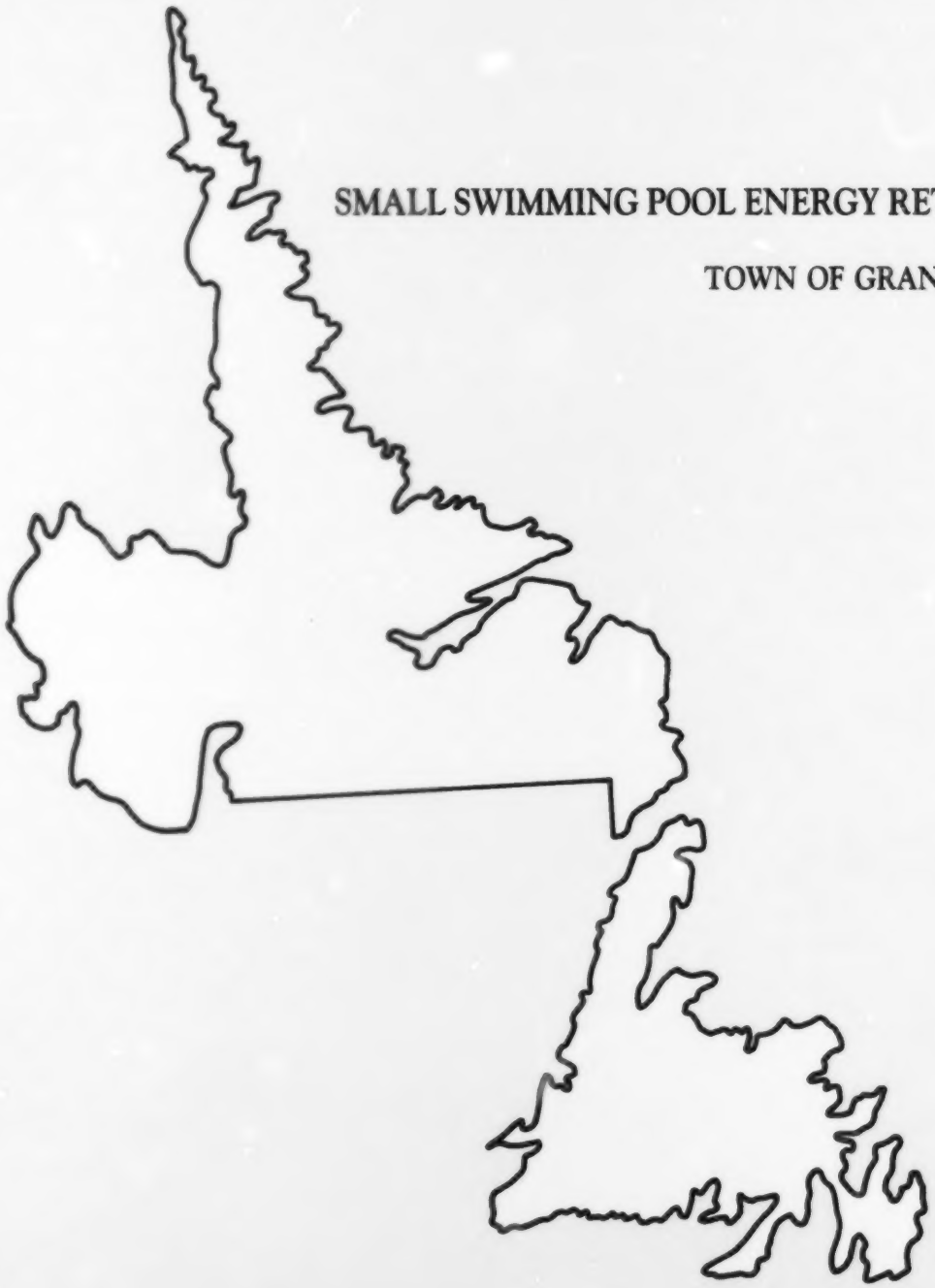
CANADA / NEWFOUNDLAND

CONSERVATION AND RENEWABLE ENERGY DEMONSTRATION AGREEMENT

SMALL SWIMMING POOL ENERGY RETROFIT

TOWN OF GRAND BANK



CR 85-03

87-04372/

SMALL SWIMMING POOL ENERGY RETROFIT
TOWN OF GRAND BANK

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Date: September 1985

Canada/Newfoundland Conservation and
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CANADA/NEWFOUNDLAND CONSERVATION AND RENEWABLE ENERGY DEMONSTRATION PROGRAM

Because of the sharp increases in the cost of oil, natural gas and electricity within the past 15 years, the search is on for economical sources of energy. Affordable energy, now and in the future, concerns everyone.

In June 1979, to help meet this demand for conservation and alternative sources of energy, the Government of Canada and the Government of Newfoundland and Labrador signed the Conservation and Renewable Energy Demonstration Agreement (CREDA).

The objectives of this $11,250,000 cost-shared program (Federal 80%, Provincial 20%) included the following:

- to develop and demonstrate promising new technologies which use renewable energy resources;
- to develop and demonstrate new and efficient technologies which conserve energy;
- to create employment in new and existing energy related industries;
- to inform the public of the economical use of new technologies as they apply to the energy resources of Newfoundland and Labrador.

The CREDA program ended March 31, 1985. For more information on this and other energy projects funded under the Canada/Newfoundland CREDA program contact:

Information Section
Energy Branch
Department of Mines and Energy
P. O. Box 4750
St. John's, Newfoundland
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(709) 576-2411

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Conservation and Renewable
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Suite 301, Atlantic Place
215 Water Street
St. John's, Newfoundland
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(709) 772-5353

PROGRAMME CANADA/TERRE-NEUVE DE DÉMONSTRATION DES ÉCONOMIES D'ÉNERGIE ET DES ÉNERGIES RENOUVELABLES

La montée en flèche du coût du pétrole au cours des 15 dernières années, du gaz naturel et de l'électricité a rendu nécessaire la recherche de sources d'énergie à bon prix. La question de l'énergie à coût abordable, pour aujourd'hui et les années à venir, touche tous les Canadiens.

Pour aider à répondre aux besoins en matière d'économies d'énergie et d'énergies renouvelables, le gouvernement du Canada et le gouvernement de Terre-Neuve et du Labrador ont ratifié en 1979 au Accord de démonstration des économies d'énergie et des énergies renouvelables (ADEEER).

Ce programme a été doté d'un budget de 11,25 millions de dollars, et le gouvernement du Canada et celui de la province s'en partageant les coûts dans une proportion de 80% et 20% respectivement. Quelques-uns de ses objectifs étaient:

—La mise au point et la démonstration de nouvelles techniques prometteuses faisant appel aux énergies renouvelables;

—La mise au point et la démonstration de nouvelles techniques efficaces d'économie d'énergie;

—La création d'emplois dans des entreprises nouvelles ou existantes oeuvrant dans le domaine de l'énergie;

—Faire connaître au public les avantages économiques de ces nouvelles techniques telles qu'applicables aux ressources énergétiques de Terre-Neuve et du Labrador.

Le programme ADEEER prendra fin le 31 mars 1985. On peut obtenir plus de renseignements sur le programme ou sur les sujets qui ont fait l'objet d'une aide financière en vertu de l'Accord Canada — Terre-Neuve sur les économies d'énergie et les énergies renouvelables en communiquant avec:

Section de l'information
Direction de l'énergie
Ministère des Mines et de l'Énergie
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Ressources Canada
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Disclaimer

"This publication was prepared under the Canada-Newfoundland Conservation and Renewable Energy Demonstration Agreement which was co-funded by Energy, Mines and Resources Canada and the Newfoundland and Labrador Department of Mines and Energy. Distribution of the report by the funding departments does not necessarily signify that the contents reflect the views and policies of these departments. Any mention of trade names or commercial products does not constitute recommendation or endorsement for use."

Energy, Mines and Resources Canada | Énergie, Mines et Ressources Canada

Mines & Energy
Government of
Newfoundland & Labrador

Swimming Pool Retrofit
Grand Bank

CREDA Project

Canada/Newfoundland Conservation and Renewable Energy Demonstration Agreement

Project Location:
Grand Bank Community Pool
Grand Bank, Nfld.

Date:
February 1984

Technology:
Conservation
Heat Recovery

Project Manager:
The BAE Group
P.O. Box 6900
St. John's, Nfld.
A1C 6H3

Project Number:
03:02:70

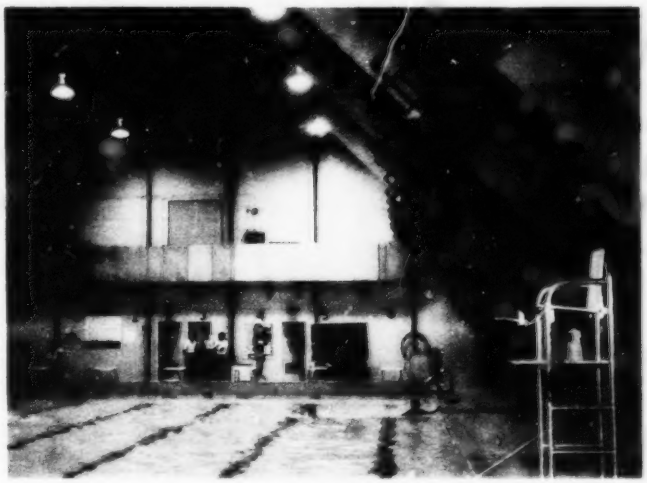
Sector:
Recreational

Status:
Completed

Province:
Newfoundland

Purpose:

To demonstrate effective means of conserving energy in typical community swimming pools throughout the province.



Description:

The 1200m^2 A Frame community pool at Grand Bank is now equipped with: a "run-around" glycol system for heat recovery; demand controller to regulate electrical load, schedule mechanical systems, and operate the night setback; and a pool blanket to conserve pool heat and reduce evaporation at times when the pool is not in use.

Contributors:

Canada/Newfoundland	$36,824
Grand Bank Pool Committee	22,600
Total	$59,424

Expected Benefits/Savings:

A 35% or 89 kVA demand reduction plus a 400,000 kWh or (40%) reduction in energy consumption.

Further Information:

A final report containing a detailed economic and energy analysis will be available in late summer, 1984.

Information Contact:

Grand Bank Pool Committee
P.O. Box 640
Grand Bank, Newfoundland
A0E 1W0
Phone (709) 832-1600

or

Information Section
Energy Branch
Department of Mines and Energy
P.O. Box 4750
St. John's, Newfoundland
A1C 5T7
Phone (709) 737-2411

Project Name:

Grand Bank Swimming Pool Retrofit

Economic Analysis:

Project Costs:

Materials	$30,000
Installation	12,824
Engineering	9,800
Monitoring and Information Transfer	10,000
Total Demonstration Cost	$62,624

Operating Costs:

Pre-demonstration annual fuel costs (1,024,320 kWh)	$35,475
Expected post-demonstration annual fuel costs	24,175
Expected net annual fuel savings	11,300

Simple Payback Period: 4.6 years

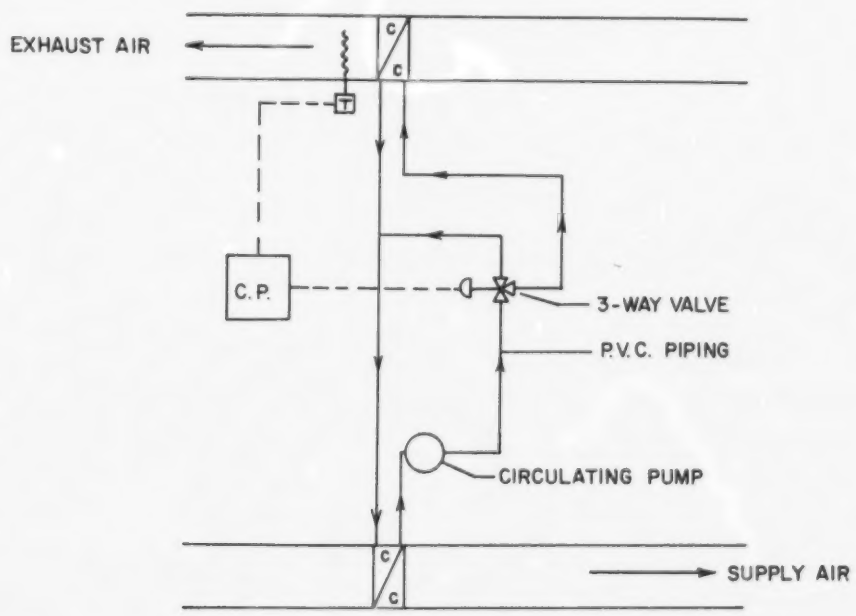
Monitoring/Evaluation:

The utility bills and operating characteristics will be monitored on a monthly basis. The information accumulated will be analysed in the final report.

Technical Details/Specifications:

The glycol run-around heat recovery system reclaims heat from the exhaust air and uses it to preheat supply air. The demand controller, programmed to prioritize demand, reduces peak demand when the facility is in operation, operates the night set-back system to reduce temperatures when the building is not in use or at night, and schedules the mechanical systems to operate only when the facility is being used.

Schematic:



T TEMPERATURE SENSOR, IT MODULATES 3-WAY VALVE TO ENSURE TEMPERATURE NEVER GOES BELOW 0.6°C (33°F).

C.P. SINGLE INPUT, SINGLE OUTPUT LINEAR CONTROLLER.

ABSTRACT

Small Swimming Pool Energy Retrofit Project, Grand Bank

The application of some basic energy conservation techniques, namely exhaust air heat recovery, energy management, and electrical demand control, has resulted in a practical solution to the high cost of energy in swimming pools. The Grand Bank project has demonstrated that savings in excess of 30 percent are possible and that costs are such to afford a payback of approximately four and one-half years.

RÉSUMÉ

Projet d'amélioration Thermique d'une Petite Piscine à Grand Bank

On a trouvé une solution en vue de réduire les frais d'énergie des piscines en appliquant certaines techniques de récupération de la chaleur contenue dans l'air expulsé à l'extérieur, de gestion de l'énergie et de contrôle du l'utilisation de l'electricité. Le projet de Grand Bank a montré qu'il est possible de réaliser des economies de plus de 30% et que les frais investis pour réaliser ces économies peuvent être recouvrés en une période d'environ quatre ans et demi.

ACKNOWLEDGEMENTS

This report would not be complete without acknowledging the efforts of Mr. William Thomasen of the Grand Bank Pool, who, without specific technical training, took it on himself to learn about the various systems, and has done an admirable job in the operation of these systems.

TABLE OF CONTENTS

	Page No.
ABSTRACT	i
ACKNOWLEDGEMENTS	ii
TABLE OF CONTENTS	iii
LIST OF APPENDICES	iv
EXECUTIVE SUMMARY	v
INTRODUCTION	1
INTRODUCTION AND BACKGROUND	1
DESCRIPTION OF DEMONSTRATION	3
SCOPE	3
RECOMMENDATIONS	3
DEMAND LIMITING & BUILDING ENERGY MANAGEMENT	4
AIR HANDLING HEAT RECOVERY SYSTEM	5
ESTIMATED COST	6
OBSERVATIONS DURING INSTALLATION & MONITORING	7
TENDERING	7
INSTALLATION & MONITORING	7
COST/BENEFIT ANALYSIS	10
ESTIMATED COSTS	10
ACTUAL COSTS	10
FUNDING	10
BENEFITS	11
CONCLUSIONS AND RECOMMENDATIONS	13
CONCLUSIONS	13
RECOMMENDATIONS	13

LIST OF APPENDICES

	Page No.
"A" - Grand Bank Swimming Pool - Pictures, Floor Plan	14
"B" - Energy Consumption	17
"C" - Retrofit Project Diagrams	22
"D" - Field Visit Reports	26

EXECUTIVE SUMMARY

The cost of energy at the Grand Bank Swimming Pool was so high that without some means to reduce those costs, the pool would probably have closed down or services would have been drastically cut.

In 1982, the Swimming Pool Committee realized that action must be taken to reduce energy costs, and it was primarily through their efforts that the CREDA energy conservation project sponsored by the Provincial Department of Mines & Energy and Energy, Mines & Resources Canada finally became a reality.

The object of the energy retrofit project was to provide a system to manage and conserve the energy being used at the pool, to reduce the electrical demand, and to provide a glycol run-around-loop heat recovery system which would extract heat from the air before it was exhausted and return it to the space.

These systems are now installed and have been operational for almost one full year. Energy consumption savings in excess of 36%, on a monthly basis, and electrical demand savings in excess of 40% have been demonstrated. Minor problems such as construction deficiencies, initial fine tuning, inexperience in the system operations, and maintenance problems have prevented these savings being realized over the full year. However, now that the systems are operating as designed, we are optimistic that savings well in excess of 40% will be commonplace in the future.

INTRODUCTION

INTRODUCTION AND BACKGROUND

The swimming pool chosen for this particular energy conservation project was the one at Grand Bank on the Burin Peninsula. The pool is physically similar to many pools around the island and, while there are others which may not look the same, the size and interior layout is, nevertheless, similar.

Most of these pools were designed and built around the same time. Unfortunately, it was at a time when very little consideration was given to oil shortage or the high cost of energy. It was not until the late seventies that the organizations running these swimming pools discovered they had a common problem - they could not afford to pay the power bill. In fact, some organizations had no choice but to close down the swimming pool. The Grand Bank pool was no exception, and without sizable grants from the municipal council, the pool probably would have been closed. A great deal of credit should be bestowed on those organizations and individuals who worked voluntarily and without professional help to keep these swimming pools operating to maintain such a valuable service to their communities.

The overall dimensions of the pool building are approximately 47 m (155 feet) long by 18 m (60 feet) wide. Seventy percent of the

area is taken up by the pool, which measures 26 m (85 feet) by 14 m (45 feet), the remainder being used for mechanical/electrical equipment rooms, dressing rooms, showers, etc. (See Appendix A)

The building is an insulated A-frame wood structure insulated with electric space heating and electric hot water heating for domestic use and to warm the pool. The pool air space and water temperature are both maintained at 27°C (80°F). The relative humidity is maintained at twenty percent.

The cost of energy in 1981 was $35,474.69, with $11,945.83 of that amount being used for demand charges. This averages out to approximately $1,000 per month for demand charges and $2,000 per month for energy charges. The costs in 1979 and 1980 were higher, and this was probably due to the fact that the building staff were not familiar with the mechanical and electrical systems. (See Appendix B)

DESCRIPTION OF DEMONSTRATION

SCOPE

The project can be broken down into three (3) distinct parts:

1. Recommendations which have immediate payback with little or no costs.
2. Demand Limiting and Building Energy Management.
3. Air Handling Heat Recovery System.

RECOMMENDATIONS

(a) Setting Humidistat Higher:

Building humidity is reduced by replacing interior air with fresh air. In the wintertime, the fresh air must be heated, making the price for low humidity high. Our recommendation was to increase the settings while monitoring for condensation to arrive at an optimum level where comfort was not compromised.

(b) Disconnect 2/3 of pool water heating capacity:

Calculations showed that the temperature of the pool water could be maintained at 80°F using approximately 50 KW of heating. The installed heating capacity was 180 KW. The larger capacity was needed to heat the large mass of water initially, but since the pool was filled only once a year, it was recommended that a gas or propane heater be used for that purpose. This one-time cost is preferable to paying electrical demand charges for 12 months. It was also recommended that the yearly maintenance on the pool be done at a time when the town water was relatively warm (summer versus winter) in order to reduce the cost of heating the pool water. It is much less expensive to heat water from 50°F to 80°F than from 32°F to 80°F. The biggest saving in this recommendation was, of course, the reduction of approximately 120 KW in building demand.

DEMAND LIMITING & BUILDING ENERGY MANAGEMENT

(a) Demand Control:

Most of the large electrical loads in the building can be turned off for short periods of time without causing discomfort to the building occupants. Consequently, the electrical demand can be substantially reduced by ensuring that all these loads (e.g. space heaters, duct heaters, pool heaters, D.H.W. heaters, etc.) are not on at the same time. This can be accomplished with a demand controller which monitors the building power consumption and sheds loads to maintain the demand below a preset limit. The controller used for this particular project is a microprocessor based programmable controller which also provides the time function for the night setback system and the scheduling of mechanical loads.

Estimated Cost:	$ 19,540.00
Estimated Savings:	$ 3,000.00
Payback:	6.5 Years

(b) Night Temperature Setback:

The temperature in the building can be reduced in the night and at other times when the building is not occupied. Another recommendation goes hand in hand with night setback. In fact, we would not recommend one without the other; that is, an insulating blanket for the pool surface. If the temperature in the pool area is reduced, the air will become saturated and condensation will occur. The insulating blanket, in addition to providing insulation for the pool water, also reduces the area of water available to the air, thus preventing condensation. A 5°C reduction in temperature should be possible. The timing function will be provided by the demand controller:

Estimated Cost:	$3,488.00
Estimated Savings:	$1,800.00
Payback:	1.9 Years

(c) Scheduling of Building Mechanical Loads:

The exhaust fan presently runs 24 hours a day, 365 days a year. The change areas and washrooms that this fan serves only require exhaust when the areas are being used, which is approximately 30 percent of the total time. By shutting down this fan for 70 percent of the time, the amount of warm air exhausted to the outside is considerably reduced. This shutdown can be provided by programming the demand controller:

Estimated Cost:	$ 423.00
Estimated Savings:	$1,500.00
Payback:	4 Months

AIR HANDLING HEAT RECOVERY SYSTEM

The air handling system is designed to remove large quantities of moisture from the pool area by providing large air flows through the space. When a large quantity of air is exhausted, it must be replaced with fresh air, and if the fresh air is cooler than the space, this fresh air must be heated. This results in two very bad effects: (1) warm air which has already been heated is thrown away, and (2) fresh air taken inside requires large blocks of energy in order to heat fresh air.

If some of this rejected heat could be recovered, the savings would be twofold in that the amount of energy required to heat fresh air would also be reduced.

The heat recovery scheme recommended was a glycol "run-around-loop" which consists of a heat exchanger in the exhaust duct which transfers the heat to glycol. The glycol is then circulated to the intake duct where the heated glycol is used to warm the fresh air. (See Appendix C)

The piping is PVC, and a 3-way valve provides by-pass to eliminate frost build-up on the exhaust side of the

coil. This system can be easily incorporated into the existing construction.

Estimated Cost:	$19,350.00
Estimated Savings:	$ 5,000.00
Payback	3.9 Years

ESTIMATED COST

The total estimated cost to implement all these recommendations was $52,624.00.

The total estimated savings was $11,300.00 for a payback of 4.65 years.

This project, because of its attractive payback, will enable the facility to continue to operate, providing a vital service to the community. Consequently, it should be of interest to other communities who operate similar facilities.

OBSERVATIONS DURING INSTALLATION AND MONITORING

TENDERING

Tenders were invited in early October, 1983 and closed on October 20th, 1983. All tenders were higher than estimated; however, by changing certain features, such as PVC pipe instead of iron and plastic valves instead of brass, and by modifying the control wiring, the low tender was reduced to a value within the original budget. A contract was signed in November and work was started in December, 1983.

INSTALLATION AND MONITORING

For the most part, the installation went smoothly and without incident. It was during the supply and installation of the equipment that certain problems were identified which had to be rectified.

The dampers in the existing air handling system were found to be only partially operative, and it was found necessary to replace them to ensure correct operation of the heat recovery system.

It was also found that to place and remove the thermal pool blanket was impractical without the use of a proper pool blanket reel system. The reel system was added and the removal and placement of the pool blanket is now a one-man operation.

Both these items were added to the project in the way of Change Orders to the original

contract and resulted in an additional cost of approximately $2,900.00.

Work was substantially complete in March, 1984; however, it was June 1984 before all deficiencies and fine tuning were completed to the point where energy savings were realized. (See Appendix D)

In August 1984, a routine check of the systems pinpointed a leak in the glycol piping which contributed to a reduction in the efficiency of the heat recovery system. Several attempts were made by the Contractor to repair the leak; however, it was not properly repaired until December 1984.

Another event of considerable signficance is that in September 1984 the pool experienced a water pipe rupture. Water was spilled over the demand controller and in order to prevent further damage, the pool maintenance personnel turned off the controller power. Although this was the proper thing to do under the circumstances, during the time the controller was out of service, the electrical demand exceeded the set limit by approximately 38 KVA. Since then an attempt has been made to convince the Power Company that this was an isolated incident and that it should not determine the building demand for the whole year. As of the date of this writing, a decision has not been made on this matter.

In February 1985, a mechanical engineer visited the site to inspect the energy management and heat recovery systems. His findings, at that time, were that, due to several maintenance and operational problems, the heat recovery system was completely inoperative. (See Appendix D, Field Visit Report dated Feb. 22/85)

This fact becomes evident by analyzing the energy bills. In January 1985, the energy consumed was approximately 6.7% less than the previous four year average, and in February 1985, the energy consumed was 12.8% higher than the previous four year average. The energy consumed in March 1985, even though the system was repaired for only two weeks of the billing period, was 30.4% less than the previous four year average. The fact that the heat recovery system was inoperative in January and February resulted in an electrical demand in February 1985 which exceeded the preset limit. The electrical demand in March 1985, after the problems were corrected, was controlled to the set-point limit of 144 KVA.

At the time of this writing, the energy consumed for April 1985 is unknown; however, based on the past performance of the heat recovery and energy management systems, we anticipate savings in excess of 40%.

COST/BENEFIT ANALYSIS

ESTIMATED COSTS

The total estimated cost of the project, excluding monitoring and information transfer costs was $52,624.00, broken down as follows:

Material	-	$ 30,000.00
Labour	-	$ 12,824.00
Engineering	-	$ 9,800.00
TOTAL		$ 52,624.00

The estimated saving in energy cost was $11,300.00 per year for a payback of $52,624 ÷ $11,300 or 4.65 years.

ACTUAL COSTS

Actual cost of the project was $55,113.01 broken down as follows:

Supply & Installation Contract	-	$41,590.00
Contract Extra	-	600.00
Solar Blanket	-	2,397.25
Blanket Reel System	-	1,433.90
Engineering	-	9,091.86
TOTAL		$55,113.01

FUNDING

The Grand Bank Town Council contributed $22,600.00 with the remainder provided by the Federal and Provincial Governments through the CREDA program. An additional $10,000.00 was provided under the program for monitoring and information transfer. The monitoring was provided by The BAE Group and consists, essentially, of the information compiled by the Department of Mines and Energy and is detailed in the attached Appendix E.

BENEFITS

The retrofit project resulted in a savings in the first year of operation of 198,808 KWH as compared to the previous three year average consumption. This translates into a direct dollar saving of $5,765.43 using the marginal energy rate of $0.029 per KWH. This does not take the fuel adjustment charge or sales tax into consideration which would, in fact, result in a higher saving. Another factor which is significant is that energy savings were only realized for eight months out of twelve because of maintenance and operational problems. (See Bar Chart, Appendix B)

The electric billing demand for the year prior to the retrofit was 240 KVA. The preset limit for the electric demand is now set at 144 KVA, and this level has been maintained over the past year.

The saving which can be attributed to demand control is 240 - 144 = 96 KVA or 96 x $4.55/ mo. x 12 mos. = $5,241.60. When compared to years prior to 1984, the savings in demand charges are even higher. Demand Graph in Appendix B shows the new preset demand compared with previous years.

Taking the actual costs and savings listed in the table on the following page into consideration, the simple payback is $55,113.01 ÷ $13,784.41 or 4.0 years.

Annual Financial Saving Summary

Item	Annual Saving	Rate	$ Saving
Electrical Demand	1,152 KVA	$4.55	$ 5,241.60
Electrical Energy	198,808 KWH	$0.029	$ 5,765.43
Fuel Adjustment	198,808 KWH	$0.00654*	$ 1,300.20
Retail Sales Tax		12%	$ 1,476.87
			$13,784.10

*Represents an average of the fuel adjustment rate for the previous ten months.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The energy conservation retrofit project at the Grand Bank Swimming Pool has been a very successful project. All objectives with respect to energy and electrical demand savings have been achieved and exceeded. It is the opinion of the system designer, after monitoring the project for ten months, that if one full year of trouble-free operation can be achieved, the energy savings will far exceed those already achieved.

This project has proven beyond any doubt that other similar swimming pools across the province can reduce their energy costs and that the savings achieved can pay for the retrofit in approximately four years.

RECOMMENDATIONS

We have three recommendations which organizations considering initiating similar projects should pay particular attention to:

1. They should engage the services of qualified consultants to do design work and supervise construction.

2. The pool should have someone on staff who is willing to learn about the operation of the systems and can periodically check the operation and make minor adjustments.

3. The operators of the pool should be prepared to engage the services of a qualified maintenance firm who can do periodic preventative maintenance to ensure the systems continue to operate as designed.

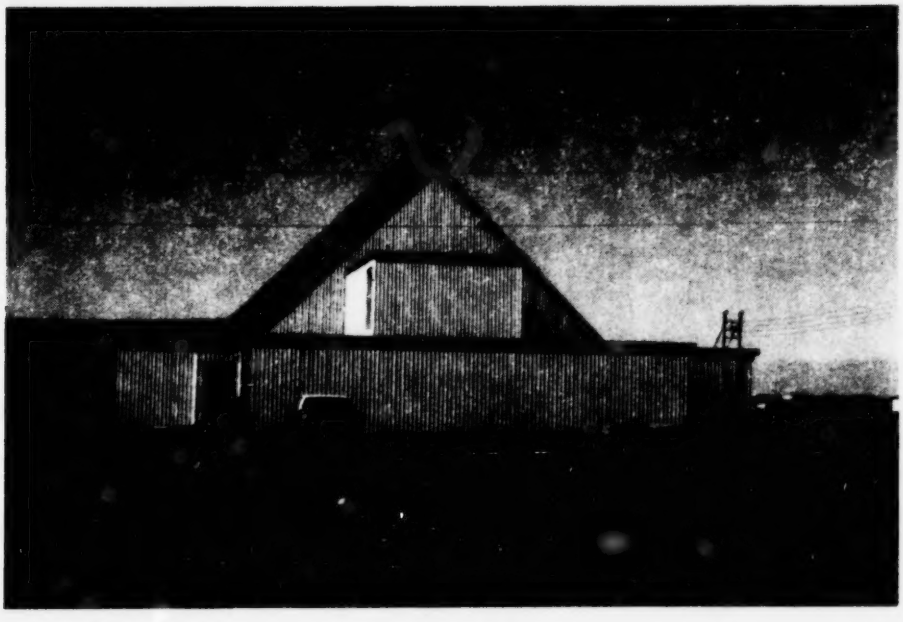
APPENDIX "A"
GRAND BANK SWIMMING POOL

- Site Photos
- Swimming Pool Floor Plan

APPENDIX "A"

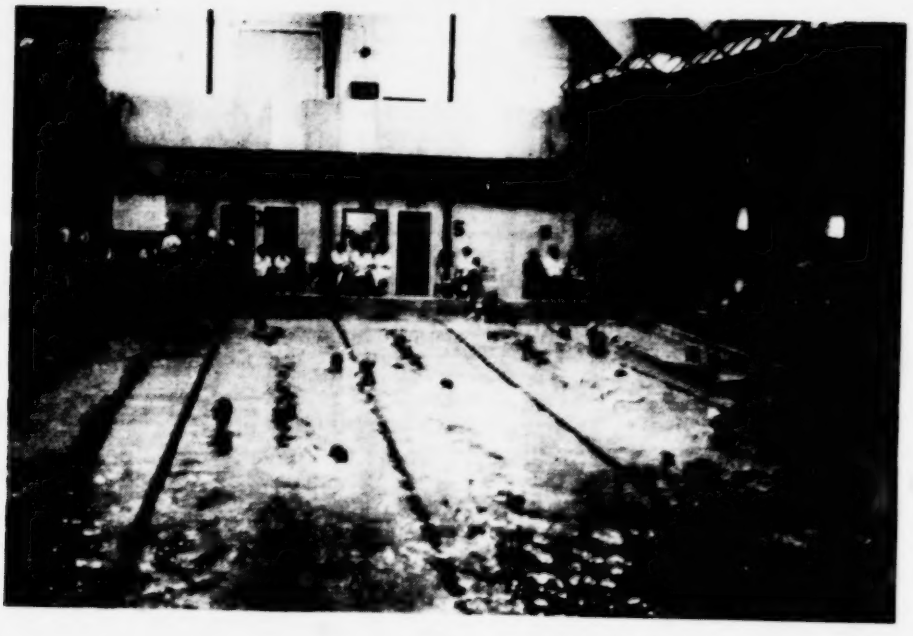
GRAND BANK SWIMMING POOL

SITE PHOTOS



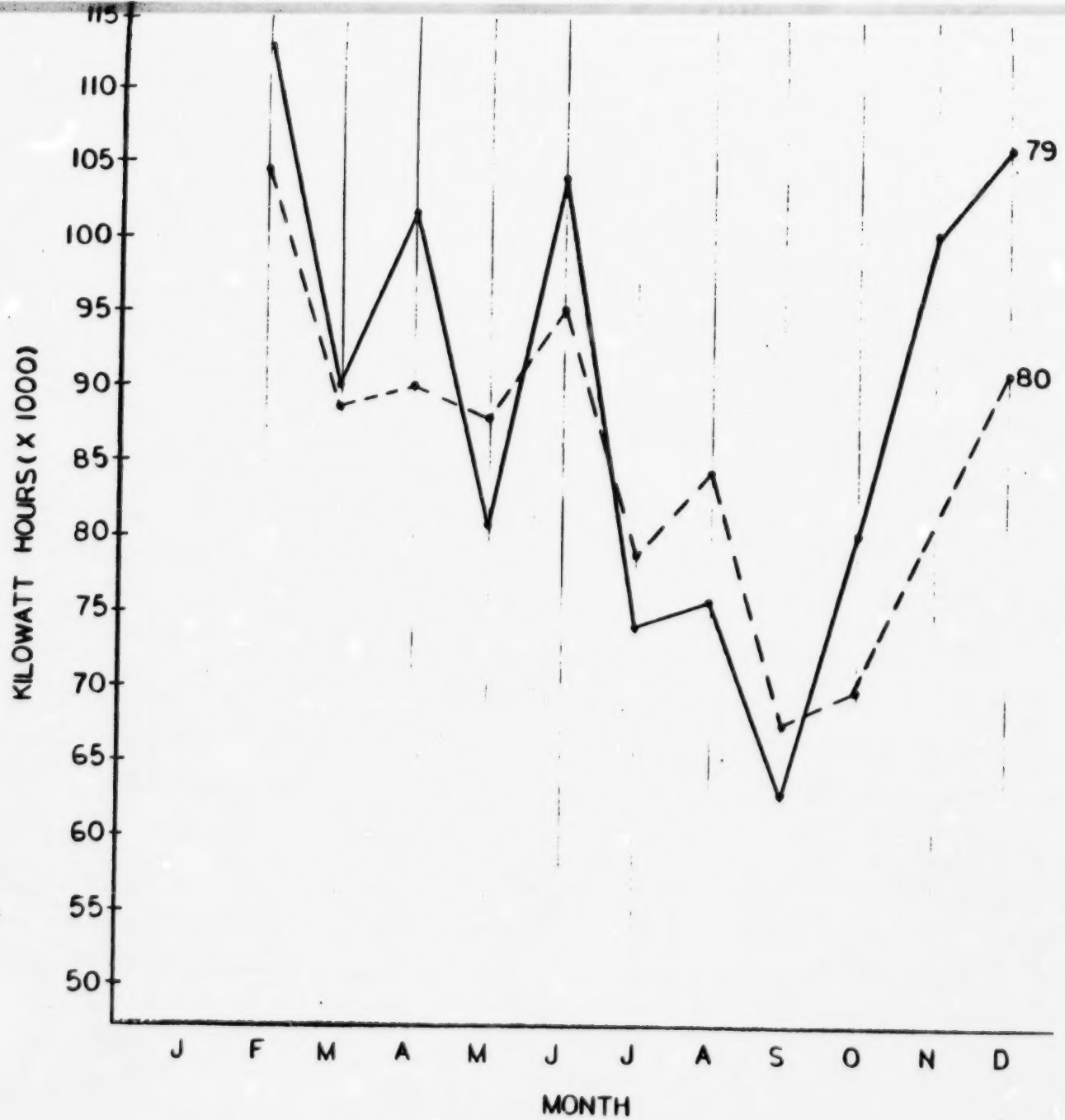
GRAND BANK SWIMMING POOL

SITE PHOTOS

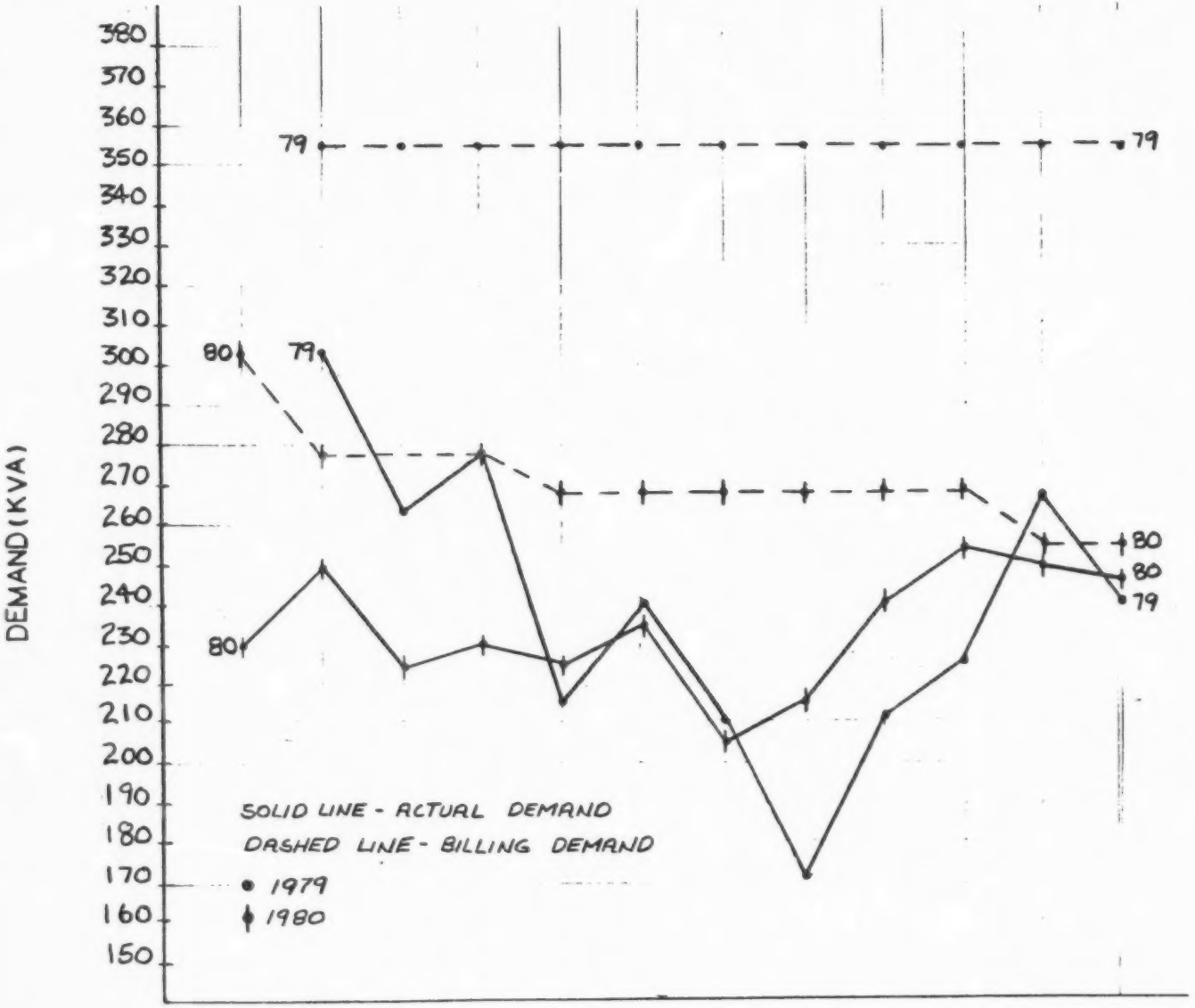


APPENDIX "B"
ENERGY CONSUMPTION

- Energy Consumption, 1978 & 1980
- Electrical Demand, 1979 & 1980
- Energy Consumption Table
- Bar Chart
- Demand Graph



ENERGY CONSUMPTION 1978 & 1980

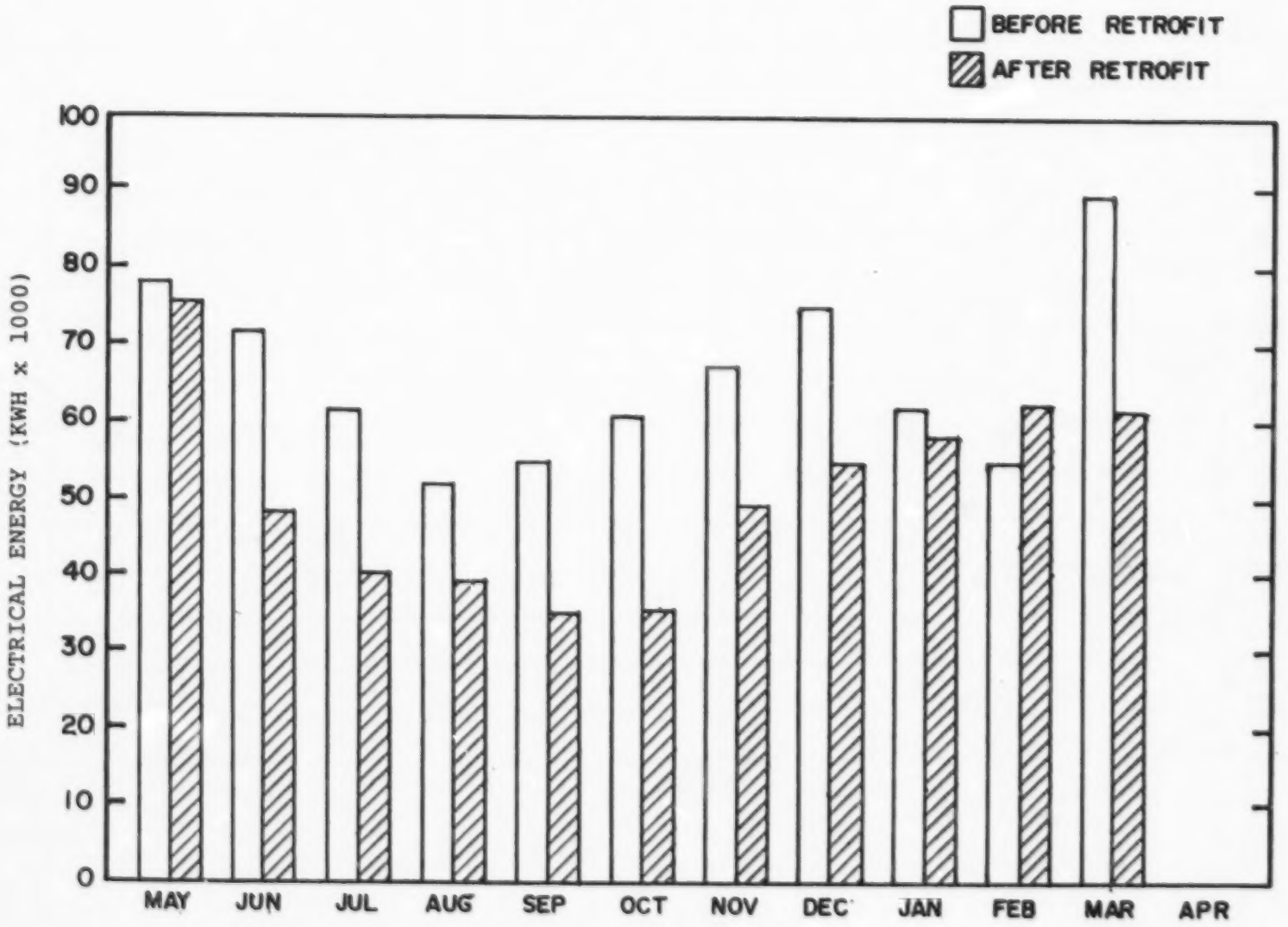


ELECTRICAL DEMAND 1979 & 1980

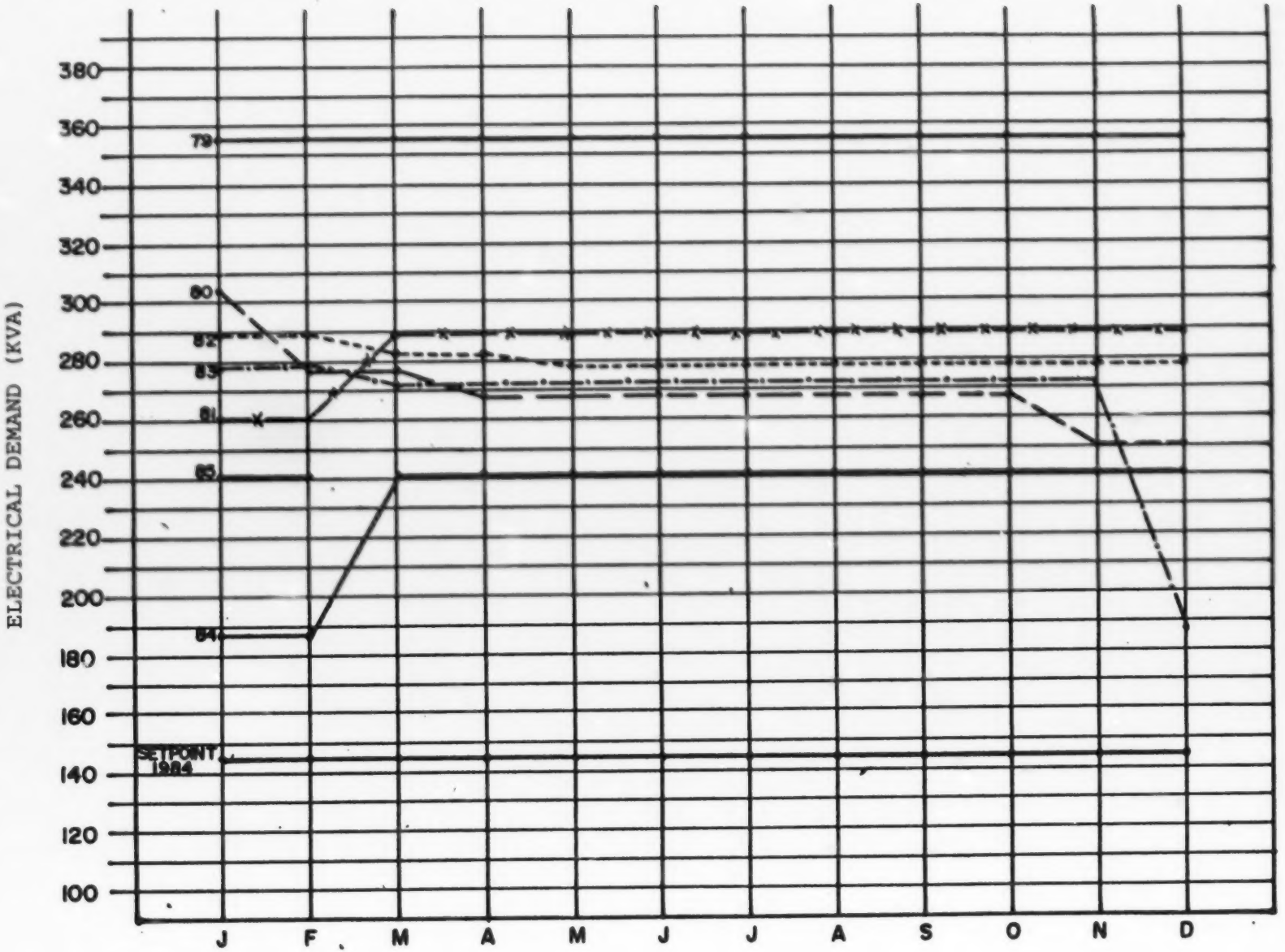
GRAND BANK SWIMMING POOL

ENERGY CONSUMPTION (KWH)

	Prior to Retrofit ←					→ After Retrofit		
MONTH	1981	1982	1983	1984	AVERAGE	1984	1985	SAVING (%)
JAN	83,520	61,920	54,240	49,440	62,280		58,080	6.7
FEB	57,600	58,080	49,920	55,680	55,320		62,400	(12.8)
MAR	100,320	109,920	65,280	80,160	88,920		61,920	30.4
APR	97,440	104,640	85,920	84,480	93,120			--
MAY	91,200	78,240	66,720		78,720	74,880		4.9
JUN	74,400	72,480	67,680		71,520	47,040		34.2
JUL	60,960	62,400	60,480		61,280	39,840		35.0
AUG	46,560	60,000	49,920		52,160	38,400		26.4
SEP	48,480	56,160	58,560		54,400	35,040		35.6
OCT	62,400	64,320	54,240		60,320	45,600		24.4
NOV	66,240	70,080	65,760		67,360	48,960		27.3
DEC	65,760	78,240	84,480		76,160	54,720		28.2



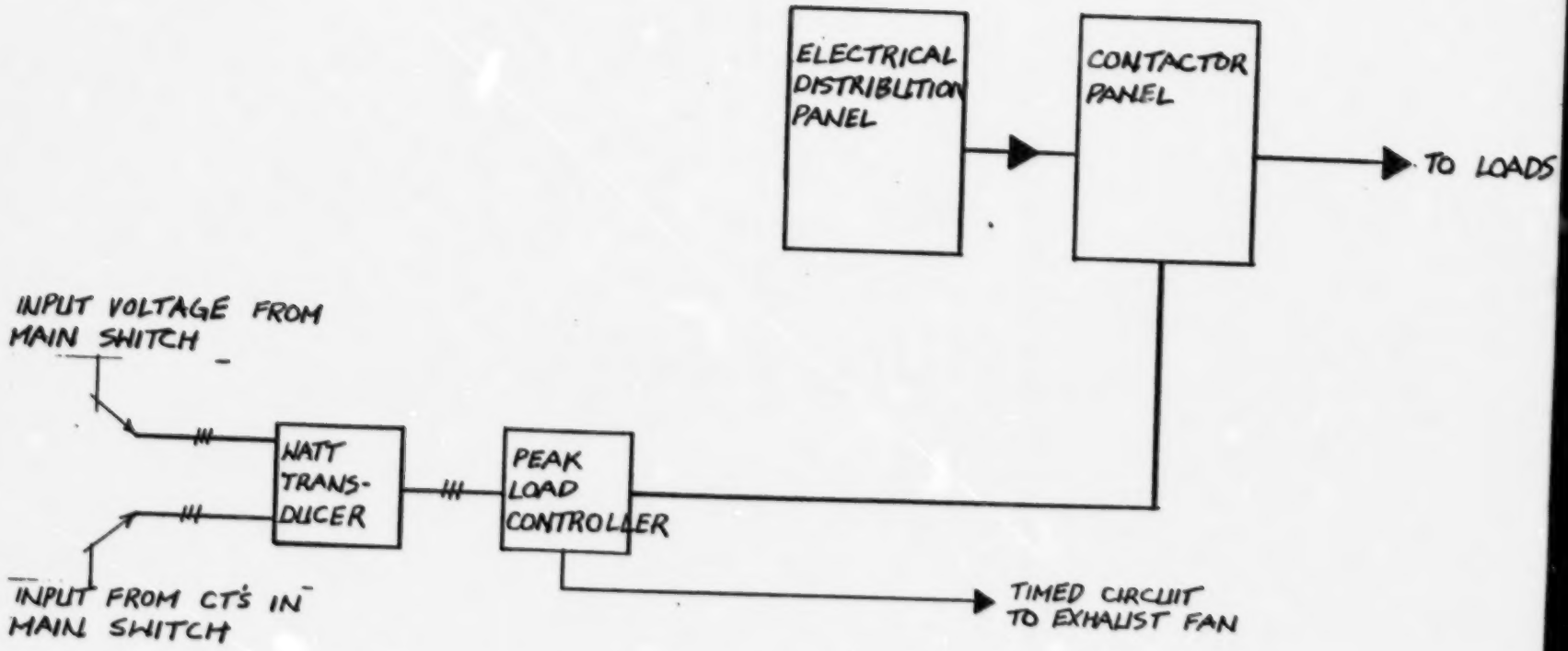
ENERGY CONSUMPTION COMPARISON



ELECTRICAL BILLING DEMAND

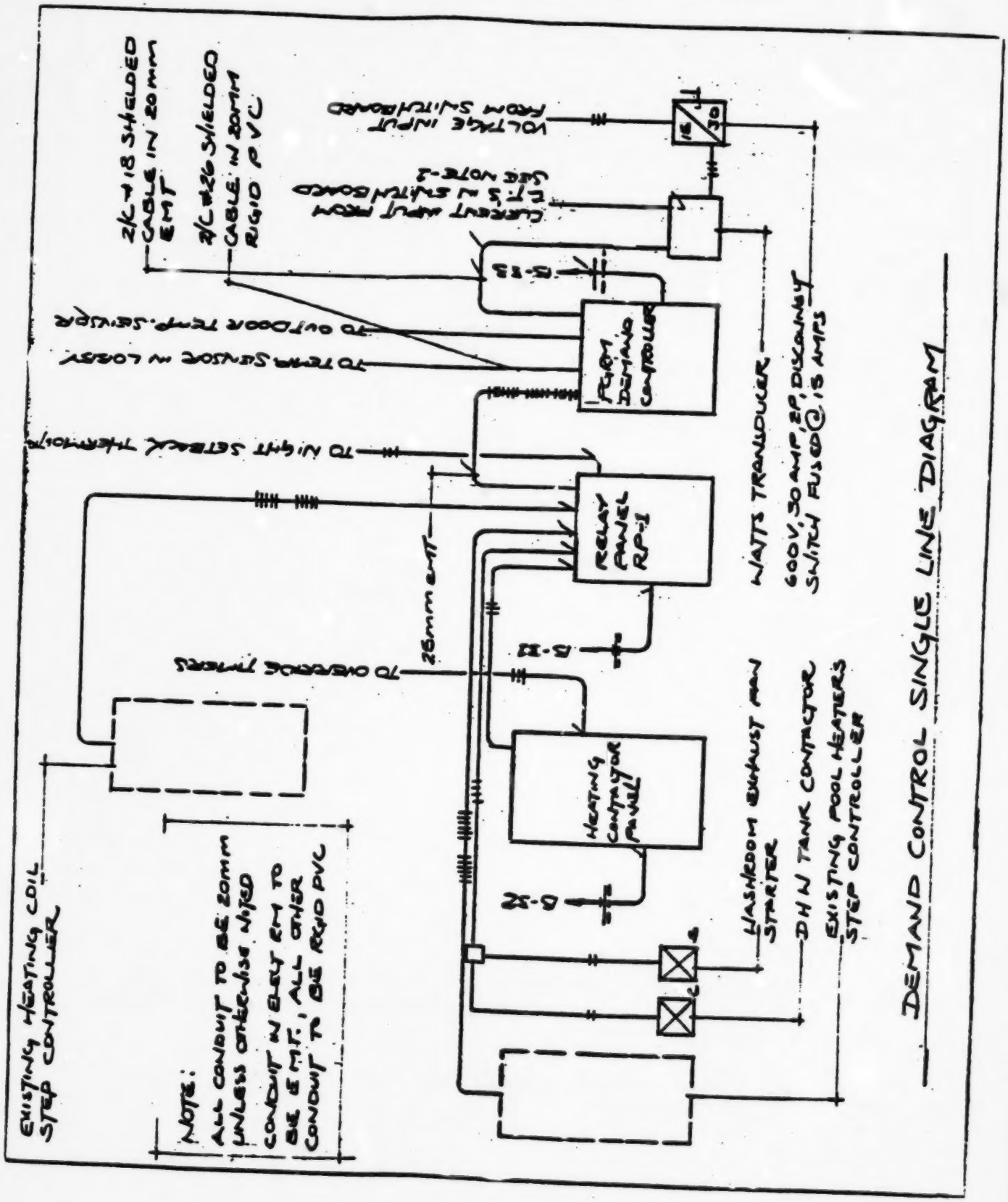
APPENDIX "C"
RETROFIT PROJECT DIAGRAMS

- Demand Load Control Schematic
- Demand Control Single Line Diagram
- Heat Recovery System Schematic
- Piping Isometric

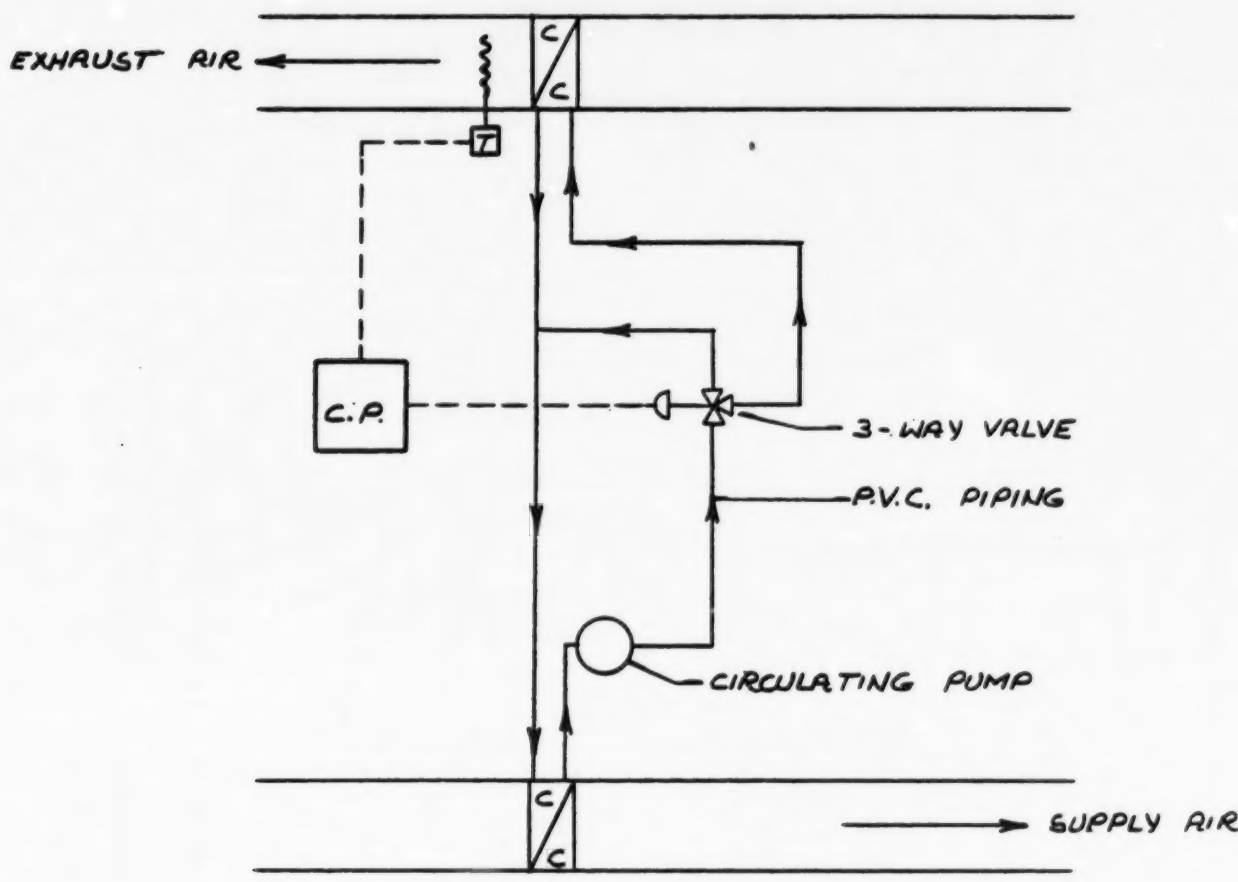


DEMAND LOAD CONTROL SCHEMATIC

DEMAND CONTROL SINGLE LINE DIAGRAM

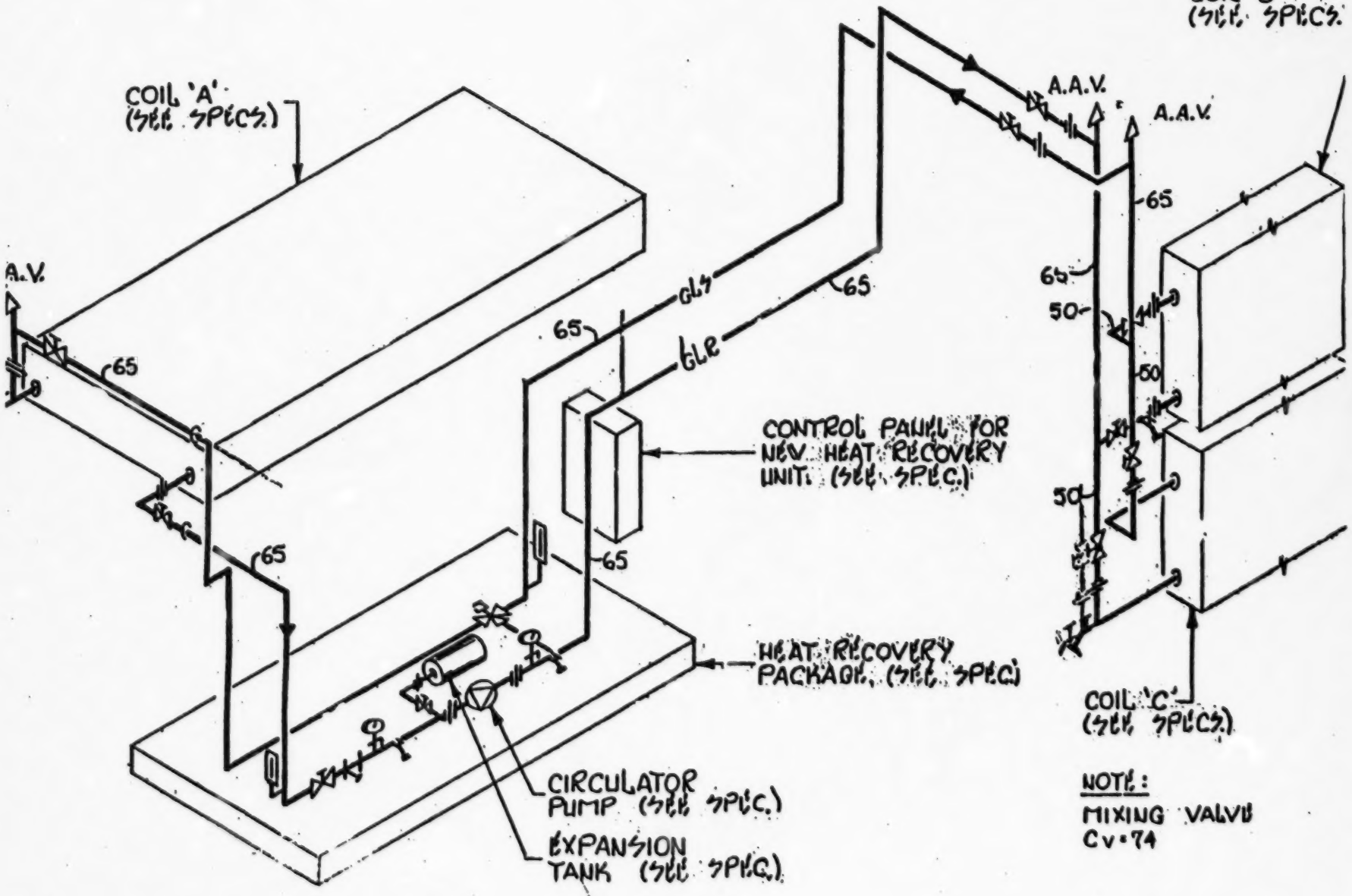

DEMAND CONTROL SINGLE LINE DIAGRAM
RDM DEMAND CONTROLLER
RELAY PANEL RP-1
HEATING CONTACTOR PANEL
WATTS TRANSDUCER
600V, 30 AMP, 2P, DISCONNECT SWITCH FUSED @ 15 AMPS
WASHROOM EXHAUST FAN STARTER
DHW TANK CONTACTOR
EXISTING POOL HEATERS STEP CONTROLLER
EXISTING HEATING COIL STEP CONTROLLER
NOTE:
ALL CONDUIT TO BE 20mm UNLESS OTHERWISE NOTED
CONDUIT IN SLAB EM TO BE E.M.T., ALL OTHER CONDUIT TO BE RIGID PVC
TO OVERHEAD HEATERS
TO NIGHT SETBACK THERMOSTAT
TO TEMP. SENSOR IN LOBBY
TO OUTDOOR TEMP. SENSOR
VOLTAGE INPUT FROM SWITCHBOARD
CURRENT INPUT FROM CT'S IN SWITCHBOARD SEE NOTE-2
2/C #18 SHIELDED CABLE IN 20mm EMT
3/C #26 SHIELDED CABLE IN 20mm RIGID PVC
26mm EMT

HEAT RECOVERY SYSTEM SCHEMATIC



T — TEMPERATURE SENSOR, IT MODULATES 3-WAY VALVE TO ENSURE TEMPERATURE NEVER GOES BELOW 33°F.

C.P. — SINGLE INPUT, SINGLE OUTPUT LINEAR CONTROLLER.



PIPING ISOMETRIC

APPENDIX "D"
FIELD VISIT REPORTS

THE BAE GROUP

FIELD VISIT REPORT

PROJECT: Grand Bank Swimming Pool Retrofit DATE: March 13, 1984

PROJECT NO. 8372 DIVISION: Electrical/Mechanical

VISIT BY: Ray Stoodley DATE OF VISIT: March 8, 1984

REPORT DESCRIPTION

Job is progressing favourably with all systems now installed. Pipes have yet to be insulated and the system needs to be balanced. A broken thermometer in the glycol line must be replaced. We consider the installation to be approximately 95% complete.

Ray G. Stoodley

RGS/ms

cc. Mr. Alf White - Grand Bank Town Council

THE BAE GROUP

FIELD VISIT REPORT

PROJECT: Grand Bank Swimming Pool DATE: May 15th, 1984

PROJECT NO. 8372 DIVISION: Mechanical

VISIT BY: Douglas R. Morris, P. Eng. DATE OF VISIT: May 10th, 1984

REPORT DESCRIPTION

Trip made to set up heat recovery system.

New return air and fresh air dampers were installed and fan speeds were increased to maximum. Also mixed air temperature control was replaced with a low limit supply air control.

In addition, the exhaust air damper was only opening halfway. This was caused by the fact the linkage was not set up properly when reinstalled after removing it to install the exhaust air coil.

The following are the results of measurements before and after modifications:

T_1 = exhaust coil entering temperature
T_2 = exhaust coil leaving temperature
T_3 = supply coil entering temperature
T_4 = supply coil leaving temperature
T_5 = exhaust coil glycol leaving temperature
T_6 = supply coil glycol leaving temperature
T_{OA} = outside air temperature

BEFORE	AFTER	
12:00 Noon	4:00 p.m.	4:30 p.m.
T_1-T_2 = 8°F	10°F	12°F
T_4-T_3 = 7°F	13°F	15°F
(68-61)	(70-57)	(72-57)
T_5 = 70°F	68°F	68°F
T_6 = 68°F	66°F	66°F
T_{OA} = 61°F	52°F	52°F

Pump P.D. = 65 psig

Cont'd.....

When we left the site, Controls & Equipment Ltd.'s technician still had some adjustments to make, but he was going to measure air flow for the supply and exhaust fans. The low limit supply temperature was set at 50°F. This control returns system to full recirculation if 50°F supply air temperature to building is reached. The thermostat bulb was placed downstream of the heating coil.

The glycol temperatures are suspect, however, because the thermometer bulbs are only about 1/2" into fluid stream and the wells are not equipped with heat conducting compound.

Until air flow measurements are received, an estimate of the system's effectiveness assuming equal air flows is:

$$EFF = \frac{T_5 - T_3}{T_1 - T_3} = \frac{(15)}{(27)} = 0.56$$

This is considered good since the maximum from these systems is .65 and a low of .50. Considering the placement of the exhaust coil, stratification in the exhaust plenum is probably contributing to this reduction in effectiveness.

Douglas R. Morris, P. Eng.

DRM/lw

THE BAE GROUP

FIELD VISIT REPORT

PROJECT: Grand Bank Swimming Pool DATE: August 2, 1984

PROJECT NO. 8372 DIVISION: Electrical/Mechanical

VISIT BY: Ray Stoodley DATE OF VISIT: July 26, 1984

REPORT DESCRIPTION

The heat recovery and energy management systems were checked and found to be in good condition and operating properly with the exception that a leak has developed in the glycol PVC piping resulting in zero pressure on the system with the pump not running. With the pump running, the differential across the pump is maintained at approximately 55 lbs.

The Contractor should ensure that the leak is repaired and the system is pressurized to approximately 10 lbs. with the pump not running.

BOND ARCHITECTS & ENGINEERS
LIMITED

for Wanda Janes
R.G. Stoodley, P. Eng.

RGS/wdj

cc: Keatings Plumbing & Heating
cc: Grand Bank Town Council

THE BAE GROUP

FIELD VISIT REPORT

PROJECT: Grand Bank Swimming Pool
DATE: February 22nd, 1985
PROJECT NO. 8372
DIVISION: Mechanical
VISIT BY: Tony Costello
DATE OF VISIT: February 19th, 1985

REPORT DESCRIPTION

A site visit to the Grand Bank Swimming Pool was carried out on February 19th, 1985 in the company of J. Chisholm of Controls & Equipment Ltd.

An initial inspection of the glycol heat recovery system revealed the following:

- Main exhaust air damper would not open when on full fresh air cycle. Therefore, not enough air flow across E/A recovery coil. The only flow was leakage around the damper (actual leakage through blades was very minimal). The system was in this condition for possibly a month (maybe more??).

- The exhaust air damper was installed horizontally in the existing E/A plenum. The existing louver was blanked off on top and is still being used on bottom. Where the plenum is divided (at the louver) there was an opening 100 mm x 1100 mm approx. Because the static across the coil is so high, the majority of the air would pass through this hole rather than across the coil; thus, the overall heat recovered is reduced substantially. (This is a construction deficiency.)

- The frost bypass control setpoint was 6°C, thereby reducing any possible heat recovery at cold ambient conditions.

- The system is controlled by humidity. The setpoint was 50% R.H. The deck area and the Mechanical Room were much drier than they had been in previous visits. The acceptable high humidity limit for a swimming pool should be just before condensate forms on the ceiling. Thus, it was suggested to Bill Tomilson that he try the setpoint around 60-65% R.H.

- The glycol thermometers showed temperatures of approximately 60°F on both the warm and cold glycol. (It should be noted that these thermometers are not suited to this application; range too high, not commercial grade.)

As the glycol system existed, there was no appreciable amount of heat recovery. (The actual recovery at these conditions was difficult to measure.)

The damper motor problem was repaired. Styrofoam S.M. was used to block off the hold and the frost bypass was set to 0.5°C. The following was recorded.

- Because the system electric heat was off during the testing and repairs, the deck temperature had dropped to 20°C. At the 20°C R/A temperature, the glycol coil could achieve a 5.6°C temperature increase on the fresh air (from 3.3°C to 9.0°C). The F/A temperature was 3.3°C because there is R/A leakage (the outside temperature was -4°C).

Cont'd...

- The electric heat was energized and after approximately 20 minutes, the deck had a R/A temperature of 23°C. At this condition, the temperature increase across glycol coil was 8.8°C.

- It was desirable to determine the glycol effectiveness at the normal operational condition of 27°C. However, the system was taking a long time to heat up.

- It is safe to say that there will be at least a 9°C rise across the coil during the winter condition. (It should be noted that there was no frost bypass required.) This rise represents approximately a 50 kilowatt coil.

In conclusion, it is unknown how long the E/A damper was malfunctioning and therefore how long the system was ineffective. The system is fine tuned now and the next month's billing should show a significant reduction in energy consumption. This may be attributed to the glycol heat recovery system.

A. B. Costello, P. Eng.

ABC/lw